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RESEARCH ARTICLE

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A Framework for Validating Information Systems Research Based on a Pluralist Account of Truth and Correctness

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Abstract

Research in information systems includes a range of approaches that make varied contributions in terms of knowledge, understanding, and practical developments. In these days of "fake news" and spurious Internet content, scholarly research needs to be able to demonstrate its validity: Are its findings true and its recommendations correct? We argue that there are fundamental validation criteria that can be applied to all research approaches despite their apparent diversity and conflict. These stem from current views on the nature of truth and the related but wider concept of correctness within philosophy. There has been much debate about the nature of truth: Is it correspondence, coherence, consensual, or pragmatic? Current debates revolve around the idea of a pluralist view of truth—that there are different forms of truth depending on the context or domain. Related to truth is the wider concept of correctness: propositions may be true, but correctness can also be applied to actions, performances, or behavior for which truth is not appropriate. We develop a framework for research validity and apply it to a range of research forms including positivist, interpretive, design science, critical, and action oriented. The benefits are: (1) a greater and more explicit focus on validity criteria will produce better research; (2) having a single framework can provide some commonality between what, at times, seem like conflicting approaches to research; (3) having criteria made explicit should encourage debate and further development. The framework is applied to a variety of empirical papers employing varied research approaches.

Keywords: Action Research, Correctness, Critical Research, Design Science, Interpretive Research, Positivist Research, Simulation, Truth, Validation.

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1 Introduction

Information systems (IS) is a wide-ranging discipline involving varied forms of research, each with different purposes. There is research aimed at producing knowledge, from a variety of perspectives—positivist (Dubé & Paré, 2003; Straub, Boudreau, & Gefen, 2004), interpretive (Klein & Myers, 1999; Walsham, 2006), critical (Klein & Huynh, 2004; Mingers, 2004b) and more; research that aims at producing software or IT/IS artifacts—design science (Hevner et al., 2004); and research that hopes to bring about improvements to organizational problems—action research (Chiasson, Germonprez, & Mathiassen, 2009). These heterogeneous forms of research are carried out in many different ways, based on different and sometimes conflicting assumptions, and often use fundamental concepts such as "information," "theory," "causality," or "knowledge" incompatibly.

We are not against the idea of pluralism in IS research at all (Mingers, 2001a, 2003), but we do agree with Lee (Lee, 1991; Lee & Hubona, 2009; Lee, Briggs, &

Dennis, 2014; Lee & Hovorka, 2015) that there needs to be some degree of coherence or rigor underlying these multifarious approaches in order to justify and validate the results that end up being published in our journals and used as a basis for affecting people's lives. This will be discussed further in Section 1.2.

In this paper, we will investigate one, crucial, element of research—that of truth or correctness—which, in many ways, underlies all the others. Scholarly research in any field aims to produce knowledge, not least within IS, where we also have the specific domain of knowledge management, which appears to have knowledge as its subject matter (Mingers, 2008). This immediately begs the question of what, exactly, knowledge is, and how it differs from mere belief or opinion. Traditionally, within philosophy, knowledge is said to be "justified true belief" (Gettier, 1963; Pritchard, 2006); that is, it is a kind of belief or opinion about how the world is but one for which we have evidence or warrant, and, essentially, that is actually true, whether or not we can in fact determine its truth. This leads to the further question of what exactly truth is, for unless we know what truth is, we cannot understand what knowledge is.[1]

1.1 Truth and Correctness

That truth is indeed a goal of IS research has been expressed, for example, by Straub et al. (2004, p. 383): "The purpose of validation is to give researchers, their peers, and society as a whole a high degree of confidence that positivist methods being selected are useful in the quest for scientific truth." However, in most published papers, including Straub et al.'s, the actual nature of truth and how it might be discovered is little discussed. This provides the starting point of this paper: What is the nature of truth?[2]

There is a traditional view within philosophy—the correspondence theory of truth (Lynch, 2001)—perhaps best expressed by Aristotle: "To say that that which is, is, and that that which is not, is not, is true." That is, there is a relationship of correspondence between beliefs or statements about the world and the way the world actually is. But, to clearly articulate a theory of truth, we need to specify its elements: What can have this truth property (known as the "truth bearer")? What could make the truth bearer true (known as the "truth maker")? Finally, what is the nature of the correspondence relationship?

There have, however, been many criticisms of the correspondence view of truth, particularly in terms of its realist view of the external world, and these criticisms have motivated a number of alternatives. For example, coherence theory, which evaluates a belief in terms of its coherence or consistency with other well-attested beliefs (Walker, 1989); pragmatism, which focusses on long-term success in practice (James, 1976; Peirce, 1878); and consensus theory (Habermas, 1978), which sees truth as that which a relevant community of inquirers agrees upon. A more radical approach known as deflationism (Quine, 1992; Strawson, 1950) suggests that truth actually has no substantive nature to be explained, and that it is really just a linguistic pseudo-problem.

More recently, in the face of the seeming standoff between these competing positions, a new approach has been developing within philosophy that aims to retain the idea that truth is a substantive concept that retains some form of realism about the relationship of truth to the external world, while accepting the criticisms of standard correspondence theory. This approach involves a pluralist view of truth: "truth is one and truth is many" (Lynch, 2009)—i.e., there are generic characteristics of truth, but these may be realized differently in different domains (Lynch, 1998; Pedersen & Wright, 2013c). For example, in the physical domain, one might hold a correspondence view, while in the mathematical domain, one might have a coherence view. These different views of truth are discussed more fully in Appendix A.

Although truth may be a defining characteristic of knowledge, as discussed above, not all IS research concerns purely knowledge. Design science, for example, aims to produce effective software or artifacts, and action research aims to solve problems in organizations. In these domains, it may actually be appropriate not to talk about truth, but rather the related term correctness (Engel, 2013; Thomson, 2008). It seems more satisfactory to say that a computer system works "correctly" rather than "truly." In many areas, truth and correctness seem equivalent: If a belief is true then it will also be correct; similarly, a belief that is incorrect would thereby be false. But, correctness is a wider term than truth in that it applies to things other than beliefs or propositions, for example actions or procedures.

The purpose of this paper, therefore, is to develop a general framework, based on the concepts of pluralistic truth and correctness, which can be applied across all areas of research in IS. Essentially, this will specify criteria for evaluating the rigor and validity of the research whatever its particular philosophy or method. This is akin to Lee and Hubona's (2009) proposal that the fundamental logical laws of *modus ponens* and *modus tollens* can be applied across many research methods to produce more rigorous research.

[1] We recognize the inevitable circularity here—knowledge requires truth, but truth requires knowledge (of truth).

[2] For good introductions to modern discussions of truth see Lynch (2001), Engel (2002) or Kunne (2003).

In the first section of the paper, we explain the pluralist view of truth. Specific theories of truth and details about the pluralist view are outlined in Appendix A. In the next section, we link truth to correctness and produce an overall framework of truth and correctness and their links to research validity. Then, in the third section of the paper, we apply the framework to a variety of research approaches—positivist statistical analysis, mathematical modeling and simulation, interpretive research, critical research, and, finally, action research. In the final section, we discuss the benefits of this framework.

A number of concerns or issues have been raised about our general approach and we wish to deal with them specifically; however, in order to avoid disturbing the logic of our argument, we have collected these together in Appendix B.

2 Philosophical Development of Theories of Truth

The issue of truth revolves around two questions: Does truth have a nature that can be analyzed? And, if so, what is that nature? The first question has provoked major debates between substantialist or robust theories of truth, such as correspondence, coherence, consensus or pragmatic theories, which claim that there is an analyzable nature, and skeptical theories, such as deflationist theories, which claim that there actually is not an underlying nature to truth, or that there can be no possible access to a corroborating external world. The major question for substantialist theories is that of realism in the sense of an accessible external world to which beliefs can correspond. The various theories of truth and their problems are explained in Appendix A. The situation within the substantialist camp had been something of a stalemate with strong and valid criticisms of correspondence theory but no satisfactory alternative (Pedersen & Wright, 2013a). This led to the development of pluralist theories of truth.

2.1 Pluralist Theories

Pluralist theories represent a new development in response to the standoff between the theories described above. Generally, many philosophers do wish to maintain a substantive version of truth and do see correspondence theory as the most intuitive approach; thus, in response to the criticisms of correspondence, they have developed the general idea that there may be different versions of truth depending on the domain of knowledge concerned. There are three possible approaches (Pedersen & Wright, 2013a). The first is strong pluralism, which sees many versions of truth with no overarching unity to them—a position not held by many. The second is weak pluralism, which holds that truth is one and many, i.e., that there is a general conception of truth, often characterized in terms of a number of properties that all forms of truth must have (called platitudes or truisms), which is realized differently in different domains. And, the third is what could be called correspondence pluralism, which maintains that there is only correspondence theory but that this itself can be differentially realized. However, some argue that this is not properly alethic[3] pluralism (Barnard & Horgan, 2013).

Putnam (1994) proposes that there are many ways in which propositions can relate to reality and that, therefore, the word "true" may be realized differently, depending on whether we are talking about physical reality, mathematics, or morality. Lynch (1998) followed this up with a functionalist approach asking what the functions of truth are—e.g., objective, correct to believe, and aimed at facilitating inquiry—suggesting that these functions could be met in different ways. Pedersen and Wright (2013c) provide a state-of-the-art view of alethic pluralism (Smith, 2015). In order to avoid burdening the paper, we discuss these approaches to truth pluralism in Appendix A.

The main point for this paper is the argument that truth is a vital component of knowledge and thus of great importance for IS research and, further, that a pluralist view of truth is most compatible with the many domains and approaches of IS research.

3 Correctness and Truth

3.1 Correctness

While truth may be seen as the constituting feature of valid knowledge, there are domains of IS in which it does not seem so appropriate, at least in any but its pragmatist forms. Examples include design science, which is concerned with the design of effective and efficient computer systems, and action research, where the aim is effective problem-solving in organizations. It does not seem appropriate to talk of a computer system being "true," but we can say that it is working "correctly." Correctness is clearly related to truth: Horgan (2001; see Appendix A) talks of truth as "semantic correctness" and Floridi (2011b) discusses a "correctness theory of truth." In this section, we will explore the notion of correctness with a view toward evaluating whether it might be a more appropriate term for at least some information systems. Based on its dictionary definition, correctness can mean three things: true or conforming with the facts, in accordance with accepted standards, and free from error. The third definition is essentially the obverse of the first two, leaving us with two—the first as a synonym for truth,

[3] From the Greek, *alethia*, meaning truth

at least as correspondence, and the second, wider meaning as conforming to some accepted or agreed-upon standards or norms (Finlay, 2010).

Many things may be said to be correct or incorrect: mental states such as believing or knowing, actions or performances such as a statistical analysis or a logon procedure, representations such as a map or a computer model, information, a move in a game, and an English sentence. What do all these things have in common and how does this relate to truth?

Thomson (2008), in a major work on norms, claims that correctness has two aspects. First, correctness is always relative to what it is applied to. A map of England may be correct as a map of England, but not correct in general. Correct is an attributive adjective like "good," it is always relative to a particular kind, *K*. The kind, *K*, fixes what properties the thing needs to have to be correct, essentially an exemplar of what the kind (or set) *K* would be. Note that some kinds of things do not have such exemplars, e.g., pebbles or shades of gray, and so cannot be correct or incorrect.

Second, with some kinds of things there are, in fact, two different ways that something may be said to be correct. Consider an action like asserting the proposition: "The computer system is down this morning." The first form of correctness concerns the manner in which the assertion is made: Is it correct English such that it makes sense and is comprehensible? This, Thomson calls "internal-correctness" or "i-correctness." Many other actions can be said to be correct or incorrect in this sense, for example playing a piece of music or spelling a word.

But with an assertion, there is a second form of correctness—that is, whether the proposition it asserts is correct, i.e., is the computer system actually down? Thomson calls this "external-correctness" or e-correctness. In the case of an assertion, e-correctness is the same as truth: Is the proposition true? This is also the case for other speech acts such as describing, answering, reporting, or explaining.

> *In short, an instance of one or other of these speech act kinds is internal-correct just in case the speaker carries out the speech enterprise correctly, and external-correct just in case the propositional content of his act is true*. (Thomson, 2008, p. 99)

One further aspect of these forms of correctness is that i-correctness is normative, i.e., there is the manner in which something ought to be done; but e-correctness is descriptive—it describes whether something is true or not, or successful or not. Also, the two are independent of each other—we can have an i-correct assertion of something false, or an i-incorrect assertion of something true (if we could understand it). However, Sosa (2009) argues that there should be a relationship between the two. For an action to be overall correct, the e-correctness must actually be caused by the i-correctness rather than being merely coincidental. For example, the correct working of an IT system should be a result of the correct procedures being used in its development.

There are many other kinds of actions that have both forms, especially purposeful actions. Here i-correctness concerns the manner in which the action is performed and e-correctness concerns whether the goal or purpose is, in fact, achieved. However, there are some actions that do not have an external relationship and so can only have i-correctness, for example playing a piece of music or spelling a word.

We can also consider mental states, such as believing, expecting, or assuming, that can be said to be correct. In these instances, Thomson argues that there can only be e-correctness—as believing or expecting is simply a mental state, it cannot be performed in a more or less correct way. Again, with these kinds of actions, e-correctness is essentially truth.

Engel (2013) considers the case of beliefs (which could, of course, be manifested in terms of propositions or statements) and agrees that the e-correctness is, in fact, truth—beliefs are e-correct when they are true. However, he argues that beliefs also have i-correctness because i-correctness concerns our evidential reasons (warrants) for believing things, which becomes normative in the sense that we should believe things backed by strong evidence, whether or not they are, in fact, true.

This provides an interesting if somewhat circular relation to truth. From the correctness perspective, many things may be correct or incorrect, but for beliefs (and their manifestation in propositions or statements) their e-correctness is a matter of truth (however construed): if they are true, they are correct. But from the truth perspective, for Horgan (2001) and Floridi (2011b) at least, truth is a matter of correctness in some form. This may appear circular, but it is a benign circularity, as we shall show in the next section—in some domains, truth and correctness are the same property.

3.2 A Model for Correctness and Truth

This section constructs a model for combining correctness and truth based on the ideas in the above discussion.

Thomson's distinction between e- and i-correctness is fundamental and is identical to distinctions made in other fields. In particular, Thomson's distinction is essentially the same as Horgan's (2001) distinction (see Appendix A) made between the semantic standards of a domain (i-correctness), and the correspondence relations between assertions and the

way the world is (e-correctness). For Horgan, all (discursive) domains have i-correctness, assuming they are coherent and well-formed domains, while some have direct e-correctness and some only indirect e-correctness (see Appendix A.3 on pluralist truth theories for more on this).

Thomson's distinction is also the same as the distinction made within the context of model and research validation (Boudreau, Gefen, & Straub, 2001; Kleijnen, 1995; Lee & Baskerville, 2003; Lee et al., 2014; Lee & Hovorka, 2015; Lukka & Modell, 2010; Sargent, 2013; Venkatesh, Brown, & Bala, 2013). Although different terms may be used, essentially there are two distinct stages to model validation, which we will call verification and validation. Verification concerns the internal structure of the model, whether it is a statistical model, a simulation model, or, indeed, a piece of interpretive research. Validation concerns the external aspect of the model—whether it adequately represents what it models. Thus, verification is i-correctness and validation is e-correctness. Within statistics and measurement theory, these are often termed precision (the degree of replicability of repeated measurements) and accuracy (the closeness of the measurement to the quantity's true value).

We briefly explain the model here and then look at particular parts in more detail in the context of information systems. In Table 1, we show how e- and i-correctness manifest themselves in various domains. The first column shows the kinds of things we are looking at—the first four rows come from Thomson's (2008) discussions of correctness, and we added the second four because they are more relevant to information systems. We do not claim that this list is exhaustive. In the next two columns, we propose how e- and i-correctness can be evaluated for each of the domains. We explain this in more detail below.

Representation covers a range of things that may have different purposes—for example, a picture or photo may just describe something, a theory may explain why something happened, a simulation model may try to replicate behavior. Whether these things are e-correct or not depends both on their correspondence but also on their purpose—e.g., a map of the London underground is not correct in terms of walking the streets.

Table 1. The Concept of Correctness Applied to Different Domains

Entity to which "correctness" may be applied	Appropriate type of i-correctness	Appropriate type of e-correctness
Doxastic mental states, e.g., believing, guessing, hypothesizing	Whether the belief is supported by sound evidence	Whether the belief is, in fact, the case (truth to different degrees)
Factive mental states, e.g., knowing, perceiving	Not relevant except that they are coherently expressed	True by definition
Assertions, propositions, sentences	Whether the assertion meets the semantic standards of the domain including justification	Whether what is asserted is the case (truth)
Representations, e.g., maps, pictures, models, descriptions, theories	Whether they meet the standards and norms for the type	The extent to which they correspond with that which they represent given their purpose (truth, practicality)
Procedures, e.g., a mathematical proof, logging into a computer account	Whether it follows the rules or axioms	Whether it succeeds (e.g., hacking an account would be e-correct but not i-correct)
Information	Whether the signs carrying the information are semantically meaningful	Whether the content of the information is true. This depends on what the information is about (truth of different kinds)
Actions, e.g., playing a game, tying a tie, performing a sonata, riding a bike	Whether they are performed in the right way according to the standards or rules	Whether it produces the right result
Normative kinds of artifacts, which may be good or defective, e.g., machines, computer systems	Whether it exemplified the standards appropriate to its kind (form)	Whether the object has the properties that would make it a "good" example of its kind (function)

Procedures are specified steps that need to be undertaken to achieve a result. A mathematical proof does not correspond to anything; nevertheless, starting from axioms and following logical rules, it can generate a conclusion. It is i-correct in terms of adhering to axioms, rules, and other potential criteria such as elegance or simplicity. It is e-correct in that if it succeeds, it demonstrates the desired result—for example, that the four-color theorem is, in fact, true. Logging into an account is e-correct if it succeeds. It may not be i-correct if done in the wrong way, for example by hacking.

Information is a disputed phenomenon with different conceptions (McKinney & Yoos, 2010). Some researchers, such as Floridi (2011a) and Mingers and Standing (Mingers & Standing, 2017), argue that information is both objective and true, in which case its i-correctness is its semantic meaningfulness and its e-correctness is its truth in some form. Others (Checkland & Holwell, 1998b) argue that information is subjective and not necessarily true, making it difficult to understand what might constitute correct information.

There are many artifacts, especially those that are humanly produced, that may have the property of "being a good K," if there are standards or properties that exemplars of such a kind exhibit. A good toaster produces evenly browned toast; a good information system produces information that is accurate, timely, relevant, and easy to use. For these examples, the e-correctness involves meeting the specified goodness criteria, which may often be in terms of function. The i-correctness concerns the form of the artifact—is it aesthetically pleasing? Is it robust and easy to use? Is it efficient? Is it economical? In such cases, there may be disagreements about which properties are part of the function and which are part of the form.

In summary, correctness has two aspects—internal and external. Internal aspects are normative, i.e., some example of a *K* is as it should be; external aspects are descriptive, i.e., some example of a *K* bears an appropriate relationship to an external state or a goal. Correctness is an attributive adjective that may be applied to a wide range of entities or actions. In some cases, e-correctness is essentially the same as truth—although not necessarily in terms of correspondence theory—in other cases it is not. Truth is thus a subset of correctness.

4 Applying the Framework to Information Systems

We began by highlighting the importance of knowledge for IS and argue that knowledge is constituted by truth, i.e., something must be true to be considered knowledge (as opposed to mere opinion or belief); however, as discussed above, proving something to be true can be extremely difficult. This led us to the concept of truth and we investigated various theories of truth, especially the pluralist versions of truth that see it as many and one. From here, we considered the intimate connections between truth and the wider concept of correctness, which could be said to subsume truth. We then developed a framework for analyzing the nature of internal and external correctness in several domains. In the remainder of the paper, we apply this framework to a range of concepts and phenomena within information systems.

In actuality, the concept of truth itself is seldom discussed in IS research papers (Becker & Niehaves, 2007; Webb, 2004), even though there are many papers that debate the nature of validity for different forms of research (Johnson et al., 2006). As discussed above, there are two distinct questions concerning truth: What is it, i.e., what is its nature? And, how do we discover it, i.e., how do we distinguish true theories from false ones? We call these the definitional and the justificational questions. The first part of the paper concerns itself with the first question, and we now move to the second, practical question: How do we justify our research conclusions?

Developing a framework that could potentially apply across all research approaches in IS is clearly a tall order, and in this paper, we only have enough space to cover what we consider to be the most prominent approaches (Galliers, Markus, & Newell, 2006; Galliers & Land, 1987; Grover & Lyytinen, 2015; Hirschheim, Iivari, & Klein, 1997; Hirschheim & Klein, 1989, 2006; Lee & Hubona, 2009; Nissen, Klein, & Hirscheim, 1991; Orlikowski & Baroudi, 1991; Venkatesh et al., 2013). In particular, we cover positivist, interpretive, critical, action research, and design science. However, we recognize that there are other approaches that we are unable to address here, for example NeuroIS (Reidl, 2018), feminist research (Wilson, 2016), and, of course, new areas that are continually developing. As stated above, we do not wish our framework to be seen as rigid and we welcome contributions from other approaches. Even concerning a particular approach, we have had to be selective in our choice of perspectives—a whole paper or even a book could be devoted to a discussion of validity within any particular domain. Essentially, we focus on trying to show that there are potential underlying commonalities across varied research approaches and that an awareness and consideration of these approaches could potentially contribute to higher quality research.

Table 2. The Correctness Framework for Selected IS Research Approaches

Form of research	i-correctness (formative)	e-correctness (summative)	Relevant forms of truth
Positivist research: statistical—positivist as defined by Straub (1989) and Lee & Hubona (2009)	• Content • Construct • Reliability • Statistical validity	• Comparison of predictions with actuality, e.g., hold-out samples or cross-validation • Elimination of alternative explanations	• **Correspondence** between constructs and concepts, and between results and actuality • **Coherence** of constructs
Positivist research: simulation and mathematical modeling	• Model comparison • Extreme conditions • Degeneracy tests • Sensitivity analysis • Replications	• Predictive validation • Historical data • Event validation • Face validation • Graphical animation • Credibility	• **Correspondence** between results and actuality • **Coherence** of model • **Pragmatism** and **consensus** about operational validity
Interpretive research—emic	• Confirmability • Dependability • Consistency • Reliability • Transgressive validity	• Credibility/authenticity in the eyes of the participants/subjects • Interpretive coherence • Pragmatic coherence: consistency between talk and action • Performativity—the stranger test	• **Correspondence** between description and participants' world • **Consensus** about authenticity of results • **Coherence** of interpretations
Interpretive research—etic	• Theoretical validity—comparison of results with theory	• Plausibility in the eyes of the research community	• **Consensus** about the plausibility of theoretical interpretation
Design research	• Methodological validity • Efficiency • Ethicality • Elegance	• Efficacy that the system works • Effectiveness that it does the right thing	• **Pragmatism** and **consensus** about operational success • **Coherence** of design method
Action research	• Declaration of theory and methodology • Active application of theory and participation in a situation • Recoverability	• Effectiveness that the problematic issue has been alleviated • Justification of theoretical contribution • Generalizability to other contexts	• **Pragmatism** and **consensus** about operational success • **Consensus** about the plausibility of theoretical learning • **Coherence** of results with methods used
Critical research	• Critical perspective and use of critical theories • Participative research design • Analysis of underlying, coercive mechanisms • Comparison with other contexts • Researcher reflexivity	• Enlightenment of individual participant • Change of social arrangements • Judged by the participants	• **Correspondence** of theory to social mechanisms • **Pragmatism and consensus** about enlightenment and change

Our framework as a whole is presented in Table 2. The subsequent sections explain how the table is developed for the various research approaches. Columns 2 and 3 concern i-correctness and e-correctness, respectively. We note, based on the discussion above, that i-correctness is essentially the same as verification, precision, or formative validity (terms used in various fields) and is normative. E-correctness, in contrast, is essentially identical to validation, accuracy, or summative validity and is descriptive. As we consider each research area, we will look at the practice and terminology of that area and then endeavor to show that it can be incorporated within our correctness

framework. Column 4 presents particular forms of truth that are relevant to the research approach.[4]

4.1 Justifying Positivist Research

Within IS, there is a considerable literature devoted to justifying empirical, positivist research. There is a strong line of good practice recommendations developed mainly from Cook and Campbell's (1979) treatise on quasi-experimentation. This was picked up by Straub (1989) and further developed in theoretical (Bagozzi, 2011; Im & Straub, 2015; MacKenzie, Podsakoff, & Podsakoff, 2011; Shadish, Cook, & Campbell, 2002; Straub et al., 2004; Venkatesh et al., 2013) and empirical studies (Boudreau et al., 2001; King & He, 2005). In theory, this approach ties directly into our correctness framework:

> *We use the term validity to refer to the approximate truth of an inference. When we say something is valid, we make a judgement about the extent to which relevant evidence supports that inference as being true or correct.…Validity is a property of inferences. It is not a property of designs or methods* (Shadish et al., 2002, p. 34)

Whether this approach ties into our correctness framework in practice is more debatable. After describing this approach in Table 3, we then critique it for being excessively narrow and technically focused and for ignoring the more general issues of internal and external validity. We then describe an alternative approach developed by Lee and Hubona (2009).

The original work (Campbell, 1957) distinguished between internal and external validity (see discussion of internal and external correctness above), while Cook and Campbell (1979) added construct validity and statistical validity. Straub et al. (2004) developed these as shown in Table 3 (construct validity becomes a part of instrument validity). These forms of validity take on quite specific meanings. First, we should note that although the title of the paper (Straub et al., 2004) is "Validation Guidelines for IS Positivist Research," which is quite general, the guidelines only refer to specific forms of statistical research that feature some underlying latent, subjective constructs, and relationships between them, which are then operationalized in terms of particular quantitative measures and an instrument used to collect data.

Table 3. Four Forms of Validity for Positivist Research Summarized from Straub et al. (2004)

Validity type	Meaning	Means of assessment
Instrument validity (three subsections: content, construct, and reliability)	Assesses the validity of the research instrument, typically a questionnaire or experiment	
• Content	Do the instrument measures adequately reflect the content of the construct they are measuring?	Literature review, expert judgment

• Construct
  ○ Discriminant
  ○ Convergent
  ○ Factorial
  ○ Nomological
  ○ Predictive
	Do the measures converge on the construct and not on other distinct constructs?	Statistical methods such as CFA, SEM, PCA
		Judgmental comparison
		Quantitative comparison

• Reliability
  ○ Consistency
  ○ Test/retest
  ○ Split half
  ○ Interrater
	Are the results/responses repeatable?	Cronbach's alpha

Internal validity	Are there alternative causal explanations for the observed data?	Not discussed
Statistical validity	Are the results sufficiently statistically robust that they are unlikely to have occurred by chance?	R-squared, F, SEM See Gefen, Straub, & Boudreau, 2000
External validity	To what extent can the findings be generalized to other populations and settings?	Not discussed

[4] Formative validity is defined by Lee and Hubona (2009) as concerned with the process of building a theory; they define summative validity as concerned with the result or product of the process.

The instrument is assumed to be some form of questionnaire or, perhaps, an experiment. The title of Straub's (1989) earlier paper, "Validating Instruments in MIS Research," is perhaps more accurate in this regard. The point is that there are other forms of positivist research beyond surveys and statistics, popular as they may be.

Moreover, most of the discussion concerns the fairly technical issues of instrument validity and statistical validity, rather than the more general ones of internal and external validity. Again, these latter concepts are defined quite narrowly and perhaps counterintuitively in this approach—internal validity only concerns the possibility of there being other causal relationships, i.e., explanations, that are not included in the model. In many ways, then, internal validity seems like an external factor since it makes direct reference to the external world beyond the model and cannot really be dealt with from a purely internal perspective.

Equally, the idea that external validity primarily concerns the extent to which results can be generalized to other populations and settings (King & He, 2005) seems mistaken. As Reichardt (2011) argues, the fundamental purpose of validation is to assess the truth of the inferences made in a model; it is not particularly concerned with how wide or narrow those inferences are: "As long as a generalization about a causal relationship is true, it is externally valid even if the generalization is exceedingly narrow" (p. 46). While generalizability is an important and much debated (Lee & Baskerville, 2003; Lee & Baskerville, 2012; Seddon & Scheepers, 2015; Tsang & Williams, 2012), characteristic of a statistical finding, it is a separate issue from the question of validity.

We should also note that this approach to validity does not properly separate validity from precision (Reichardt, 2011). One of the fundamental distinctions in statistical inference is that between accuracy and precision. An estimate or inference may be accurate but imprecise (having wide confidence intervals) or it may be inaccurate but precise. Validity concerns the accuracy of the inference rather than its precision, but these are conflated in the validity typology.

Finally, this approach makes almost no reference to the fundamental issue of designing a study in the first place in such a way that the eventual results will form valid answers to the research questions. It takes for granted the development of appropriate constructs, hypotheses of the relationships between them, and the initial determination of the appropriate measures and data collection instrument; yet, these factors are arguably much more important for overall validity or correctness of the research findings than is instrument validity (Johnston & Smith, 2010). As the empirical research shows (Boudreau et al., 2001; Jones, 2004; King & He, 2005; Straub, 1989), in many cases of papers published in leading journals, even the most basic aspects such as describing and justifying the methods of data collection and analysis are absent.

Lee and Hubona (2009) provide an alternative approach to validation. Their primary aim is to produce a framework that can apply to both qualitative and quantitative research based on the logical forms of argument—*modus ponens* (*p* implies *q*; if *p*, then *q*) and *modus tollens* (*p* implies *q*; if not q, then not *p*)—which they call the MPMT framework. They distinguish between formative validity and summative validity (taking these terms from education research) and suggest that much IS research involves formative validity but little summative validity. Formative validity is the process of forming or producing the theory or inference; thus, this type of validity concerns the extent to which the research has correctly followed an accepted procedure. Summative validity is a characteristic of the sum result or product of the process that has been followed. It involves comparing the consequences or predictions of the theory with observed evidence according to the logic of *modus tollens*. If a consequence or prediction of the theory cannot, in fact, be observed, then the theory does not have summative validity and could potentially be rejected. Lee and Hubona show that this approach can apply to quantitative research, qualitative research, and even systems design—a system may be designed according to an accepted systems design methodology and yet still fail to meet its aims. They also argue that, of the two, summative validity is more important than formative validity, even though in practice it is seldom demonstrated, particularly in positivist research.

In order to generate summative validity in statistical-type research (which is the content of this particular section), Lee and Hubona (2009) argue that statistical validity, in the sense of significance tests or confidence intervals for various fitted parameters that constitute the hypothesized relationship, is not sufficient. This is actually part of formative validity. It is also necessary to test the theory's predictive capabilities on out-of-sample data points using hold-out samples or cross-validation. We should note, however, a very common problem pointed out by Lee and Hubona—the fallacy of affirming the consequent. If we find that predictions are, in fact, correct, does that prove or confirm the theory? The answer is unfortunately "no," since there could always be some other explanation that accounts for the results. This can be expressed in logic—*p* implies *q*; if *q*, then *p*—which is not a valid inference. This point relates to Straub's issue of internal validity, which concerns alternative explanations. We would suggest that this internal validity is misnamed and is really external or summative validity: in seeking to confirm predictions, one must also actively try to eliminate alternative explanations (see Section 4.4 on critical realism below).

In terms of the correctness framework, it seems clear that Lee and Hubona's (2009) approach fits very well. Formative validity is essentially identical to internal correctness, while summative validity is the same as external correctness; the two types of validity are related but independent. We would hope that formative validity (i-correctness) would lead to summative validity (e-correctness), but this is not guaranteed. However, it would be possible to reach summatively valid research conclusions even through research that was formatively weak. These conclusions are summarized in the "Positivist research—statistical" section of Table 2, which presents formative validity through four of Straub's terms and develops summative validity based on Lee and Hubona. The primary form of truth is correspondence between the model and the actual situation or, less strongly, between the results and the data if the model is primarily predictive rather than explanatory. However, coherence truth also exists between the various constructs.

4.1.1 Other Forms of Positivist Research

The previous section was primarily concerned with statistical-type research, but there are many other potentially relevant forms of positivist research, for example simulation or mathematical modeling (Galliers & Land, 1987). In this section, we briefly consider simulation as representative of these.

Simulation involves building a computer model that is intended to replicate the behavior of a real-world system of interest. There are three major types—discrete event (DES), system dynamics (SD) and agent-based modeling (ABM)—which employ different modeling techniques but are similar in terms of correctness. Simulations are generally developed for a specific purpose, e.g., better understanding of a system, improvement of a system's operations, or the design of a new system, and therefore involve decision makers and others potentially affected by the results. It is important that these stakeholders have confidence in the correctness of the simulation and its results (Sargent, 2013). While subject to some debate, the correctness of a simulation is generally evaluated in terms of verification and validation (Robinson, 1997), although its credibility with users is also important (Robinson, 2002).

Sargent (2013) discusses simulation correctness in terms of three elements: the object system that is to be simulated, the conceptual model of that system, and the computerized version of that conceptual model. In this case, verification concerns the correctness of the model and its computer implementation and validation includes three components: conceptual model validation that the conceptual model is a correct representation of the object system, operational validation that the outputs of the computer model are sufficiently accurate with respect to the object system for the purpose at hand, and data validation that the available data is sufficiently correct for model building, evaluation, and testing.

These three forms of validity are independent but interrelated. If the conceptual model is invalid, then it is unlikely that the final model will have operational validity. If appropriate and valid data are not available, then a valid conceptual model could be built but not operationalized. It is also important to emphasize that validity is not absolute but always relative to the purposes of the simulation exercise: to understand puzzling behavior, a fairly simple model may be sufficient, but to help operate a complex production plant the model may need to be highly detailed and complex.[5] The general advice is to keep the model as simple as is possible to meet the objectives (Robinson, 2007). Credibility depends, to some extent, on validity: a verified and validated model should generate credibility. However, special steps may be taken to improve it—for example, participation by stakeholders in the development process and techniques such as hi-res animated graphical outputs.

There are many techniques and tests used in verification and validation (Sargent, 2013). Verification might involve comparison with other models, extreme conditions tests, degeneracy tests, sensitivity analysis, replications, trace tests, etc., while validity might be demonstrated by predictive validation, comparison with historical data, event validation, face validation, graphical animation, or structured walkthrough.

In terms of our framework, verification is clearly associated with i-correctness and the various forms of validation align with e-correctness. Credibility is interesting in that it could either be conceived of as separate from the correctness of the model, or it could be regarded as the ultimate form of e-correctness in that if the model is not believable to clients, then it fails, no matter how good it is. These aspects of verification and validity are also related to different theories of truth (Becker, Niehaves, & Klose, 2005; Schmid, 2005). Clearly, the primary forms of validity rely on correspondence theory, while verification, especially comparison with other models, can be seen as associated with coherence theory. The issue of credibility can be seen as pragmatic/consensus, as rationally acceptable under ideal epistemic conditions. These results are shown in the second row of Table 2.

[5] The point that validity is not absolute but relative to purpose is seldom mentioned but also applies to the statistical modeling discussed above.

4.2 Justifying Interpretive Research

Qualitative or interpretive research is a much more complex area in terms of validation and truth (Cole & Avison, 2007; Goldkuhl, 2012; Lee, 2018; Myers & Avison, 2002a, 2002b; Walsham, 2006). First, there is a wide variety of methods that differ significantly in their ontological and epistemological assumptions, from relatively objective postpositivist approaches such as grounded theory (Glaser & Strauss, 1967) or "subtle realism" (Hammersley & Atkinson, 1995), to textual analyses such as semiotics (Mingers & Willcocks, 2014; Mingers & Willcocks, 2017), hermeneutics (Cole & Avison, 2007; Myers, 2004; Ricoeur, 1981) and discourse analysis (Cukier, Ngwenyama, Bauer, & Middleton, 2009), to highly subjectivist or constructivist approaches such as phenomenology (Boland, 1985; Introna & Ilharco, 2004; Mingers, 2001b; Schutz, 1972) and poststructuralism (Dreyfus & Rabinow, 1982; Foucault, 1980). Second, there is debate even within methods regarding whether some form of external or even internal validation is possible at all. Seale (1999, p. 471), for example, is concerned with quality in interpretive research but suggests that

> *Quality does matter in qualitative research, but the modernist headings of validity and reliability no longer seem adequate to encapsulate the range of issues that a concern for quality must raise. The constructivist critique of criteriology has led us to see that "quality" is a somewhat elusive phenomenon that cannot be prespecified by methodological rules.*

He goes on to argue that, because of the critiques of extreme subjectivists and postmodernists, we should not expect that interpretivist research should rigidly follow any philosophical or methodological principles or guidelines (as Feyerabend [1975] argued many years ago). While this may seem to be directly against our intentions, Seale actually ends up rather close to them:

> *What I would like to see is some sense of there being a community of social researchers who have respect for the strengths of a variety of positions within that community, appreciating the need also to develop research skills taken from a number of genres (quantitative as well as qualitative, in fact)* (p. 476)

We see our framework as potentially helping this process by exploring underlying commonalities among research genres. Where we differ from Searle, perhaps, is in believing that research in each genre can benefit from some guidelines as to what constitutes high-quality research in that genre.

Sandberg (2005, p. 46) states:

> *At the same time as advocates of interpretive research deny the possibility of producing objective knowledge, they want to claim that the knowledge they generate is true in some way or another. But how can they justify their knowledge as true if they deny the idea of objective truth?*

Sandberg's goal is actually similar to ours in that "it is argued here that although objective truth cannot be achieved, truth claims are feasible using criteria consistent with the basic assumptions underlying a research approach" (p. 47). He goes on to say: "This strategy…allows us to speak about justification or '*correctness*' of a knowledge claim. Here, '*correctness*' does not mean representation of objective reality but rather a process of justification" (p. 52, our italics). Sandberg's "correctness" is, in our terms, i-correctness, and with it comes the possibility of e-correctness.

Papers in IS that provide guidance on doing interpretive research generally fail to discuss validity. For example, Klein and Myers's (1999) authoritative paper provides seven principles that should be applied in interpretive research (primarily limited to hermeneutics) but say little about validation principles. Similarly, Sarker et al. (2013) review empirical studies and also offer guiding principles but do not discuss validation.

Interpretive research begins from the position that its object of study, whether actions, texts, beliefs or discourse, is socially constructed by the actors involved. Therefore, its primary task is to gain an authentic understanding (Verstehen) of that meaning in the terms of the actors who produce it rather than in terms of theory or the interpretations of the researchers. For some researchers, e.g., ethnographers, that is sufficient, whereas others would wish to go further by interpreting the results and perhaps relating them to theory.

Moving to possible validity criteria, some of the first were proposed by Lincoln and Guba (1985; Seale, 1999; Shenton, 2004) as a direct analog to the criteria for positivist research discussed (and criticized) above: internal validity—credibility; external validity—transferability; statistical validity—confirmability; and reliability—dependability. Lincoln and Guba (1986) later argued that these criteria are overly influenced by the concerns of positivist research and suggested that these four criteria constituted the trustworthiness of research but that other conditions concerned with the wider application and results of the inquiry (which they called term authenticity) were also needed. These conditions include fairness, sophistication, enlightenment, and empowerment to act. However, as

Seale (1999) points out, these rather "political" commitments are themselves highly value laden.

Maxwell (1992) suggested three forms of validity based partly on different stages of the project. The first is descriptive validity, which solely concerns the quality of the data production process: that it is comprehensive, accurate and not subject to dispute (although the participants may themselves hold different and perhaps contradictory viewpoints, which should be faithfully recorded). The second is interpretive validity, which goes beyond merely recording events, actions, and discourse to generating interpretations of it; however, interpretive validity still proceeds from the participants' point of view not the researchers. Interpretive validity has thus been described as an "emic" viewpoint rather than an "etic" one (Headland, Pike, & Harris, 1990)—as an insider viewpoint rather than an outsider viewpoint. Interpretive validity involves the faithfulness or authenticity of the account to those involved, but even here the boundaries are blurred because actors are not always fully transparent to themselves and, as Giddens (1979) emphasizes, there are often unknown conditions and motivations for action. The third form of validity is theoretical validity, which moves away from an emic account to an etic one. The researcher aims to develop theories to explain particular observed behaviors. Theory could come from within, as in the case of grounded theory, where the theory is developed internally from the research material, or theory could come from without, when theory that already exists is applied to explain a given situation.[6]

Sandberg (2005), like us, is concerned with validity as truth—in his case, being truthful to lived experience within whichever theoretical or methodological perspective is adopted. He also distinguishes reliability (i-correctness in our terms) as concerning the procedures for achieving truthful interpretations. Reliability concerns the researcher's own subjective awareness of their (unavoidable) subjectivity and potential bias (Kvale, 1995). Researchers need to strive to avoid bias in terms of selection and analysis of material and to recognize their "perspectival subjectivity," which cannot ultimately be avoided (Gadamer, 1975).

Sandberg proposes three different aspects of validity: communicative validity, pragmatic validity, and transgressive validity. Communicative validity aims for coherence—coherence of understanding between researcher and participants, coherence in a hermeneutic sense within the interpretation of the material, and coherence between the researcher and other researchers and participants within the practice. Pragmatic validity aims for consistency between what the participants say and what they actually do. This is necessary because participants' accounts are not always open and honest since they may be mediated by politics, storytelling, social codes, or impression management (Alvesson, 2003). Transgressive validity is orthogonal to the other two types of validity and seeks ambiguity, complexity, and contradiction.

Lee and Hubona (2009; Lee, 2018) argue that their MPMT framework applies equally to interpretive research. They give the example of the hermeneutic understanding of a text (in terms of summative validity), which maintains that if a researcher has a correct interpretation of a text, then it should be consistent with any particular passage or set of passages (MP). But, if a contradiction arises, then that implies that the interpretation is not correct (MT). They suggest that this approach is a realization of the hermeneutic circle. This is the only actual example they give, but they do analyze a set of interpretive papers and find that all but one discuss formative validity alone, in terms of the processes employed; they do not try to test their interpretation in a summative way. For testing summative validity in research approaches other than hermeneutics, they follow Sanday's (1979) and Schutz's (1962) proposals that the interpretation should be understandable and acceptable to actors in a situation and should potentially enable a stranger to act appropriately within the culture (the stranger test). We can call this aspect of validity authenticity.

Venkatesh et al. (2013), based on a consideration of several of the above typologies, suggest another threefold classification of validity: design validity (which includes descriptive validity, credibility, and transferability); analytical validity (which includes theoretical validity, dependability, consistency, and plausibility); and inferential validity (which includes interpretive validity and confirmability). In comparison with Maxwell's typology, Venkatesh et al.'s classification seems rather confusing to us. Design validity actually includes elements of descriptive and interpretive validity (i.e., it is concerned with the validity of the process) mixed with generalizability. Analytical validity seems to include elements of both interpretive validity and theoretical validity, and inferential validity seems to go back to interpretive validity rather than to inferences beyond the situation.

[6] Maxwell does discuss two other forms of validity—generalizability and evaluative validity. We consider the former, as argued in the section on quantitative research, to be orthogonal to the primary question of truth and validity. The question of evaluation, i.e., judging actions to be right or wrong, will be further considered below in Section 4.4 on critical research.

Table 4. Summary of Five Different Types of Criteria for Interpretive Research Developed from the Literature Review

Reliability: criteria concerning the research process	Validity: criteria concerning the results from the participant viewpoint	Theory: criteria concerning the relationship to theories	Plausibility: criteria concerning the relationship to other researchers	Applicability: criteria concerning the generalizability of the results
Confirmability: that the research is carried out and documented in a self-critical way **Dependability:** researcher bias and subjectivity is recognized and minimized **Consistency:** that the research process has been carried out in a systematic manner **Reflexivity:** that the researcher is aware of potential biases and also their subjective/theoretical perspectives **Transgressive validity:** that the researcher seeks contradictions and anomalies in the data	**Credibility/ authenticity/ descriptive:** that the results faithfully record the participants' experiences and beliefs as judged by the participants **Interpretive:** going beyond pure description to interpretations/ explanations but still in the participants' terms **Coherence:** that the interpretation makes sense as a whole hermeneutically **Pragmatic:** that there is consistency between what the participants say and what they actually do **Performativity:** "the stranger test"	**Theoretical:** the extent to which the results are used to generate new theory or existing theories are used to explain the results	**Plausibility:** that the results are believable, realistic and persuasive to other researchers	**Transferability/ applicability:** the extent to which the results could be applied in other contexts

This whole area is clearly complex and confusing in its terminology. In Table 4 we summarize the concepts in terms of the research process and the relationships of the research results to four other entities: the participants, other researchers, existing theory, and results in other contexts.

Based on our validity and correctness point of view, we wish to articulate a classification that is quite general and compatible with many of the particular approaches. We would therefore make one main distinction, that between emic and etic research. In emic research (which must necessarily come before etic research), the primary concern is with reproducing in as authentic and rich a manner as possible, the way of life of the actors within a situation of interest in their own terms. This includes both descriptive and interpretive validity in Maxwell's model. Some research, for instance descriptive ethnography, may choose to stop there but, increasingly, there is a view that even ethnographic research should move toward some form of explanation (Kakkuri-Knuuttila, Lukka, & Kuorikoski, 2008; Lukka & Modell, 2010). This viewpoint would move research toward etic research, which is either based on or generates theory, is expressed in the researcher's language, and must be plausible to the research community. This is congruent with Cole and Avison's (2007) use of the trustworthiness of the research process and the truthfulness of the results. Based on our correctness framework, both emic and etic research will have both i-correctness (formative) and e-correctness (summative) validity criteria, as shown in Table 2. Column 1 of Table 4 essentially provides the i-correctness criteria for the emic research described in Table 2, and Column 2 of Table 4 provides the e-correctness criteria for the emic research in Table 2. Columns 3 and 4 in Table 4 provide the i- and e-correctness criteria, respectively, for the etic research described in Table 2.[7] We do not feel that

[7] It may seem contradictory that *theoretical* validity criteria (from Column 3 Table 4) could form part of formative i-correctness in Table 2 since theory is normally the result of a research process and thus summative or e-correct. But, in this particular case, the *process* of etic research involves theory comparison or construction; thus, it is reasonable that theoretical considerations form part of the i-correctness criteria.

generalizability (included in Table 4) is relevant for correctness.

In terms of the truth criteria in Table 2, correspondence does play a part, in that the research aims to authentically mirror the participants' world even though the authenticity of the mirroring can only be judged by the participants. Coherence is also relevant in assessing the overall interpretation and consensus, in that participants judge authenticity and other researchers judge the plausibility of the results.

4.3 Justifying System Design: Design Science and Action Research

We consider these two somewhat different approaches together for two reasons. First, they share purposes that make them different from the research approaches we have thus far considered: that is, they both aim to bring about beneficial changes in organizations, one through the development of an IT artifact, the other through problem solving, which might include the development of artifacts. Second, these similarities have already been noted in the literature (Baskerville, Pries-Heje, & Venable, 2009; Järvinen, 2007; Lee, 2007; Sein, Henfridsson, Purao, Rossi, & Lindgren, 2011; Wieringa & Moralı, 2012), although Iivari and Venable (2009) suggest that the similarities may not be deep. Nevertheless, from the viewpoint of validation they do have significant commonalities.

Design science is concerned with producing new and innovative IT artifacts to solve organizational problems (Hevner et al., 2004), although Lee et al. (2015) point out that such artifacts should be termed IS artifacts, not just IT artifacts. As Hevner et al. (2004, p. 78) note, "design is both a process (set of activities) and a product (artifact)—a verb and a noun" and this concords with the two aspects of correctness in our framework—i-correctness (formative) as conforming to a process or methodology, and e-correctness (summative), as successfully achieving a goal or purpose (in this case, in terms of organizational stakeholders).

Various proposals have been made for a design science methodology (Gregor & Jones, 2007; Hart & Gregor, 2010; Vaishnavi & Kuechler, 2008). These proposals that have been integrated by Peffers et al. (2007) into the following general stages (we include Hevner et al's [2004] guidelines in parentheses where appropriate):

1. Problem identification and motivation (2. Problem relevance)
2. Define objectives for solution (6. Design as a search process)
3. Design and development (1. Design as an artifact; 5. Research rigor)
4. Demonstration (4. Research contributions; 7. Communication of research)
5. Evaluation (3. Design evaluation)

Note that here the fifth step is actually an evaluation—in particular, an evaluation of whether the artifact does indeed meet the objectives that were required of it (summative or e-correctness).

Venable et al. (2012) have developed a detailed and comprehensive framework of different methods for assessing both formative and summative validity. It is based initially on the 5E's approach to evaluation (Checkland & Scholes, 1990)—efficacy, efficiency, effectiveness, elegance, and ethicality. Of these, efficacy and effectiveness primarily concern summative validity, while the other three concern formative validity. Efficacy is the extent to which the artifact performs as it is designed to, and effectiveness is the extent to which performing those tasks is actually successful in the organizational context: Does performing those tasks do what it is supposed to do? Is that the right thing to do?

In terms of formative validity, the researcher must first evaluate whether the artifact was designed according to a rigorous methodology of some kind? Then, one must question whether the artifact was developed with an economical use of resources (efficiency), according to ethical principles, and, ultimately, elegantly and aesthetically (e.g., the Mac vs. the PC)? One would like to think that formative validity would lead to summative validity, but unfortunately the high number of IS failures that still happen (Dwivedi, Wastell, Laumer, Henriksen, Myers, Bunker, Elbanna, Ravishankar, & Srivastava, 2014; Georgiadou & George, 2006) demonstrate that this is not the case. These forms of validity are presented in Table 5 and are also included in Table 2. In relation to truth, the primary form would clearly be pragmatism because it demonstrates that the system works effectively and offers consensus about that (although there can be disagreement about whether a system is successful or not). Pragmatism also looks for coherence in terms of the design method used and its results.

We now move to action research; however, as we have shown, many consider action research and design science to be intimately linked. Nevertheless, we will deal with them separately in terms of validation, even though Wieringa and Morah (2012) actually define the concept of "technical action research" as a specific method for evaluating design science. Action research (AR) (Checkland & Holwell, 1998a; Eden & Huxham, 1996) has a long history dating back to Kurt Lewin (1946) and comes in many varieties including action learning (Revons, 1993), action science (Argyris, Putnam, & Smith, 1985) and participatory action research (Whyte, 1991). Action research has repeatedly been recommended for IS research (Baskerville & Wood-Harper, 1998; Baskerville, 1999; Chiasson et al., 2009; Davison, Martinsons, & Kock, 2004).

Table 5. Summary of Different Types of Criteria for Design Research

I-correctness (formative)	E-correctness (summative)	Truth
Methodological correctness • Does the design follow a methodology declared in advance?	**Efficacy** • Does the system perform in the desired manner for the appropriate users?	**Pragmatism** and **consensus** as to the extent of practical success **Coherence** of the methodological process
Efficiency • Does the design process use a minimum of resources? • Does the designed system use a minimum of resources?	**Effectiveness** • Does the system's performance contribute to the goals of the wider system of which it is a part?	
Elegance • Does the designed system incorporate appropriate aesthetic and ergonomic principles?		
Ethicality • Does the system operate according to ethical principles?		

Table 6. Summary of Different Types of Criteria for Action Research

I-correctness (formative)	E-correctness (summative)	Truth
• **Declaration** of theory and methodology • **Active application** of theory and participation in a situation • **Recoverability**	• **Effectiveness:** that the problematic issue has been alleviated • **Justification** of theoretical contribution • **Generalizability** to other contexts	**Pragmatism** and **consensus** about operational success **Consensus** about the plausibility of theoretical learning **Coherence** of results with methods used

Given the variety of action research types, we consider a very broad description of AR as being constituted by several elements performed in a cyclical manner:

1. Initial recognition of problematic issue and entry of researcher
2. Declaration of theories and methodologies thought to be relevant
3. Undertaking action to improve the situation as both participant and researcher (in participatory AR the actors are also seen as participant researchers)
4. Evaluating results in terms of improvement to the particular organizational situation
5. Evaluating results in terms of the theory/methodology used to disseminate the learning

Checkland and Holwell (1998a) also emphasize the importance of "recoverability," or the explicit documentation of the process followed and decisions made, which will help generate theoretical lessons and facilitate later critical scrutiny. In terms of the correctness or validity of the process (Baskerville & Wood-Harper, 1998; Checkland & Holwell, 1998a; Eden & Huxham, 1996), we consider i-correctness (in Table 2) in terms of the extent to which the AR process was followed (declaration of theory, application of theory and participation, and recoverability; and e-correctness in terms of two distinct criteria), the success in terms of resolving the problem, and the learning and development of theory that may be applicable elsewhere. It is the latter criterion that mainly distinguishes action research from pure consultancy. Forms of truth are similar to design research—pragmatism in terms of whether an action was successful, consensus about that success, and coherence between the different parts of the research and the results. Our analysis of action research is summarized in Table 6 and is also presented in Table 2.

4.4 Justifying a Critical Approach

In this section, we will cover a range of explicitly critical approaches mainly based on the work of theorists such as Bourdieu (Kvasny & Keil, 2006), Foucault (Willcocks, 2004) and Habermas (Brocklesby & Cummings, 1996; Howcroft & Trauth, 2005; Klein & Huynh, 2004; Myers & Klein, 2011; Mingers, 1980), as well as critical realism (Johnston & Smith, 2010; Mingers, 2004b; Mingers, Mutch, & Willcocks, 2013), and critical versions of interpretive approaches such as critical ethnography (Myers, 1997) and critical discourse analysis (Cukier et al., 2009). A critical

approach, or the idea of critique, has two lineages: one traceable to Kant and one to Marx (Cecez-Kecmanovic, 2011; Mingers, 2000). Kantian critique concerns the limits of our knowledge and research methods while Marxist critique concerns the oppressive nature of society. Generally, both are involved in a critical approach. However, a critical approach is not primarily about research methods but about attitudes and values (Cecez-Kecmanovic, 2011; Morrow & Brown, 1994). In other words, there are not specific critical research methods; rather, both traditional quantitative and qualitative are used, but with a critical intent.

Alvesson and Deetz (2000) provide perhaps the most general framework for doing critical research that involves three stages:

- Insight: hermeneutic understanding and the archaeology of knowledge. This stage involves gaining knowledge and appreciation of the situation of interest using a range of ordinary research methods, both qualitative and quantitative. But, research is guided by explicitly critical attitudes and values and views the subjects as active participants in the research rather than as passive objects.
- Critique: deconstruction and the genealogy of knowledge. This stage involves using varied critical theories and constructs to uncover and reveal the often hidden or suppressed mechanisms that distort the participants' understandings of the situation and act to maintain this power differential.
- Transformative redefinition: enlightenment and emancipation. This stage aims at enlightening participants to the true nature of the situation and thereby helping them bring about change. It also reflexively develops social theory. Final validity is determined by the judgment of the participants.

Table 7. Different Approaches to Critical Research

Alvesson and Deetz (2000)	Myers & Klein (2011)	Cecez-Kecmanovic (2011)	Johnson et al. (2006) based on Kincheloe & McLaren (2005)	Critical realism (Bhaskar, 1994; Mingers, 2009, 2014)
Insight	• Interpretive research • Utilize critical theories	Critical understanding • Critical theory concepts • Emancipatory values • Choice of research methods	• Research designs that are participative and democratic, and approximate Habermas's ideal speech situation. • Reflexive analysis of researchers' interests and assumptions	• Science is value-laden not value-free and should be used to understand the true nature of society
Critique	• Explicitly adopt social values • Reveal and challenge the status quo	Critical explanation and generalization • Hidden mechanisms • Wider contextualization • Social and power relations	• Critical ethnography to sensitize researchers and participants to how society distorts the subjectivities of participants • Comparison of particular context with other comparable ones	• Explanatory critique: a critique of the false beliefs held by social actors and the social/ organizational structures that maintain them
Transformative redefinition	• Emancipation • Improve society • Improve social theory	Open discourse • Nondistorted communication • Transformative praxis • Reflexive dialectic	• Catalytic validity: the extent to which the research changes participants' self-understandings and thereby enable them to change the situation • Credibility for participants is vital	• Theory practice consistency: Given the explanatory critique, this should lead to action dedicated to removing the constraints and ills. • This should then be universalized to similar constraints and problems in other contexts.

Table 8. The Correctness Framework (Table 2) Illustrated with Empirical Examples

I-correctness		E-correctness	
Criteria from Table 2	**Evaluation of paper in terms of criteria**	**Criteria from Table 2**	**Evaluation of paper in terms of criteria**
Positivist research (statistical): Mishra & Agarwal (2010), "Technological Frames, Organizational Capabilities, and IT Use: An Empirical Investigation of Electronic Procurement" (72 cites)			
• Content • Construct • Reliability • Statistical validity	• Content validation was from an extensive literature review • There is an explicit section called "Instrument validation." Construct and reliability validation was provided by EFA, Cronbach's alpha, and other tests. Convergent validity and discriminant validity were also demonstrated. • Statistical validity was assessed Shapiro-Wilks, VIF and other tests on the assumptions	• Comparison of predictions with actuality, e.g., cross-validation • Elimination of alternative explanations	• There was no apparent summative validation either in terms of cross-validation or consideration of other explanations
Interpretive research: Staehr (2010) "Understanding the Role of Managerial Agency in Achieving Business Benefits from ERP Systems." (84 cites)			
Emic • Confirmability • Dependability • Consistency • Reliability • Transgressive	• It was stated that an interpretive case study method was used. This consisted of semi-structured interviews with 24 informants from 4 organizations. The researchers stated they were outside observers. It was stated that Klein & Myers's seven principles were followed but no evidence of this was supplied. • The research was documented and Nudist was used but there was no discussion of researcher bias or subjectivity and no attempt to seek contradictions	**Emic** • Credibility/ authenticity in the eyes of the participants/ subjects • Interpretive coherence • Pragmatic coherence: consistency between talk and action • Performativity—the stranger test	• There is little evidence in the paper that any attempt was made to check the researchers' interpretations and understandings with the participants other than giving interviewees the transcripts of the interviews for checking. • There was no discussion of the reliability or consistency of the information the participants provided.
Etic • Theoretical validity: comparison of results with theory	• This research did use theory—Giddens's structuration theory—as a lens to interpret the cases, as well as an ERP benefits framework	**Etic** • Plausibility in the eyes of the research community	• There is no evidence that the results were tested with the research community; however, publishing the paper (and perhaps presenting at conferences) could be seen as part of that process.

Critical research: Young, Kuo & Myers (2012), "To Share or Not to Share: A Critical Research Perspective on Knowledge Management Systems" (33 cites)			
• Critical perspective and use of critical theories • Participative research design • Analysis of underlying, coercive mechanisms • Comparison with other contexts • Researcher reflexivity	• The paper explicitly discusses validity in terms of Myers & Klein's (2011) principles that we include in Table 4. • In terms of critical theory, they use Foucault's concepts of power and gaze. • The research design is participative. • Analyzed coercive mechanisms of surveillance within the KMS • No external comparison • No explicit consideration of researcher reflexivity	• Enlightenment of individual participant • Change of social arrangements • Judged by the participants	• It was not clear that the results were fed back to the participants or that they brought about any change to the individuals or society. • They argued that a different epistemology for KMS was provided, which enabled participants to emancipate themselves from unwanted controls.
Action research: Puhakainen & Siponen (2010), "Improving Employees' Compliance Through Information Systems Security Training: An Action Research Study" (263 cites)			
• Declaration of theory and methodology • Active application of theory and participation in a situation • Recoverability	• The methodology and content of the training were developed before the AR • The process, which was cyclical, followed the AR stages as described by Baskerville (1999). A training course was designed, delivered, and evaluated. • The process was well documented (and indeed written up as a paper) and so was recoverable for future learning	• Effectiveness, in the sense that the problematic issue was alleviated • Justification of theoretical contribution • Generalizability to other contexts	• Considerable evidence was presented that the training resulted in improved security consciousness in both the employees and the CEO. • Key findings from the research were reflected back onto the initial theory and also compared to similar studies in other fields.
Design science research: Rosenkranz & Holten (2011), "The Variety Engineering Method: Analyzing and Designing Information Flows in Organizations" (27 cites)			
• Methodological validity • Efficiency • Ethicality • Elegance	• The research follows the stages of Vaishnavi and Kuechler (2008) which are similar to Venable et al. (2012). The viable systems model (VSM) (Beer, 1985) is used as a methodological base. • The method was applied in several different field studies during development as "micro-evaluations." • In some studies improvements in efficiency and effectiveness were noted • Ethicality and elegance were not considered	• Efficacy that the system works • Effectiveness that it does the right thing	• A software prototype was developed to demonstrate proof of concept although this is not an actual, working system. • Some of the "micro-evaluations" demonstrated improved effectiveness.

Table 7 shows how a range of critical research approaches can be mapped to Alvesson and Deetz's (2000) three stages. I-correctness concerns the process of research and analysis itself and evaluates whether it has properly followed the research steps, primarily from the Insight and Critique stages presented on Table 7. We selected a subset of these approaches, since many overlap, to form the characterization of i-correctness given in Table 2. E-correctness concerns the actual success of the critical analysis in terms of the change of consciousness of the participants and changes in oppressive social arrangements. This is ultimately judged by the participants themselves rather than the researchers. These criteria come from the Transformative Redefinition section of Table 7 and, again, we included only a subset in Table 2.

5 Illustration of the Framework

In order to better illustrate the framework, we applied it to a range of case studies as shown in Table 8. This is not intended to be exhaustive, but simply illustrative; furthermore, it does not constitute a formal validation of the framework, which would be a topic for future research. However, Table 8 does show that the framework can be applied to a wide range of research approaches and that it can yield powerful evaluative points. In order to select the papers, we searched Google Scholar for recent (2010 and later) papers in journals with "information systems" in the title that used the terms "empirical" or "case study" and the appropriate research approach. If there was a choice, we selected highly cited papers from top-quality journals. The only area that proved difficult in this regard was design science; while there were many theory and methodology papers, there were few empirical examples. In each example in Table 8 we list the correctness criteria from Table 2 and then evaluate the extent to which each paper meets or adheres to these criteria.

Summarizing the results, the positivist paper met the i-correctness (as did many others) criterion but not the e-correctness criterion, a finding that echoes Lee and Hubona's (2009) results. The interpretive paper met some of the criteria but not others. In terms of emic correctness, this paper claimed that it followed Klein & Myers's (1999) principles, but there was no evidence of this and little attempt was made to check the validity of the results with the participants. In terms of etic correctness, this paper used theory and the process of dissemination may have involved other researchers.

The critical paper adhered strongly to i-correctness, explicitly following a set of validity guidelines in applying critical theory concepts, but it was weak in terms of e-correctness—there was little attempt to allow the participants to validate the results or to bring about actual change. The action research paper was strong in terms of both i-correctness and e-correctness, demonstrating both that the intervention was successful and that it led to interesting theory. The design science paper followed a rigorous methodology and used "micro-evaluations" through the design process. In the end, however, only a prototype was developed, not a fully working system.

We believe that Table 8 demonstrates that our framework can be used successfully to evaluate research that has already been carried out; future research could involve a more extensive evaluation of published papers. The framework can also be used to develop and inform research that is still in progress.

6 Conclusion

We would first like to make clear what we are not suggesting in this research. First, we are not prescribing or privileging any particular research methods; indeed, our whole argument is based on the idea that all approaches may well be able to contribute to information systems research, whether in terms of knowledge, understanding, or practical developments (Galliers & Stein, 2018b). This is true both for a single research method as well as for a combination of methods within a multimethodology (Mingers, 2001a, 2011; Venkatesh et al., 2013), which is our preferred option. Second, we are not suggesting direct changes to specific research methods, whether they be the statistical analysis of surveys or the coding of ethnographic data, but we are suggesting that research methods should be carried out with more concern for and consideration of their validity.

The implications of our analysis of truth and correctness are as follows. Research is often carried out and published with little explicit regard for its validity (Boudreau et al., 2001; Gonzalez & Sol, 2012; Jones, 2004; King & He, 2005; MacKenzie et al., 2011; Straub, 1989; Wieringa & Moralı, 2012). For research to make a genuine contribution, either to knowledge or to practice, and to be published in journals or lead to organizational change, every effort must be made to demonstrate that the results are valid, that is believed to be true or correct.

As we have demonstrated, there are two fundamental and distinct characteristics—internal correctness and external correctness, also known as verification and validation, or formative and summative. The first is normative and concerns the way that research should be carried out; the second is descriptive and concerns the relationship of the research findings to the external context. We have demonstrated both of these criteria in the framework and across a wide range of research approaches. We agree with Lee and Hubona (2009) that much less attention is paid to e-correctness than i-correctness; yet, arguably, the former is more important.

It is tempting also to align these two types of correctness with rigor and relevance. Certainly i-correctness concerns the rigor of the research and e-correctness is related to the relevance of the research, at a minimum. Although some very abstract research may not initially seem to have much direct relevance, one only needs to think of the laser or prime number theory to see how such research may later become highly relevant. In some ways, our work could be seen as similar to that of Rosemann and Vessey (2008), who are concerned with improving the relevance of IS research. They produced applicability checklists to assess the practical relevance of research through focus groups and nominal group techniques. Our framework can be used similarly to improve the rigor of research; but, clearly, the e-correctness component already includes relevance in methods such as design science or action research that specifically aim for change. Nevertheless, one could also specifically include relevance as a criterion in other forms of research if desired.

We believe that it is important that we have produced a framework that encompasses a wide range of methods. Too often, different research methods are seen to be in competition or even in conflict with each other. This framework demonstrates that all research methods can be seen as sharing some very basic characteristics and that all are ultimately part of the same human drive to better understand and improve the world. By focusing explicitly on both internal and external correctness, we hope that the results of research will become more informative and effective.

In a recent debate hosted by the *Communications of the Association for Information Systems*, McBride (2018) raised the age-old question (Galliers & Stein, 2018a) of whether IS should be seen as a science, characterizing science purely in terms of positivistic statistical analysis. McBride actually suggested that it should not, that it should rather be seen as more akin to a complex, multilevel humanities discipline such as dance. From the point of view of this paper, we rather agree with his characterization of IS as multifaceted but disagree with McBride's characterization of science as purely positivist. Instead, we would adopt a critical realist view that science is a much broader and more pluralistic search for knowledge in many heterogeneous domains. Each domain (including those to come in the future) has its own objects of knowledge that require its own research methods to access. Our framework offers a deep-level basis or foundation for these varied research approaches and seeks to maintain their integrity as "inquiring systems" (Churchman, 1971) through focusing on i- and e-correctness.

Research needs to develop in a way that explicitly considers both these aspects of correctness at all stages—the design of the research, its operationalization, and its description and dissemination. We hope that our framework can provide guidance for researchers to consider as they design their research, and for referees and editors to look for when evaluating submissions or grant applications.

In terms of limitations and further research, we note the following: The framework could be developed to include further research approaches that we have not considered, for example theoretical computer science, neuroIS, feminist research, or multimethodology. It could also be developed internally to provide greater discrimination within approaches, especially in the interpretive area, where it may be found useful to have different criteria for, say, hermeneutics, phenomenology, textual analysis, and semiotics. The advantage of a framework such as ours is that it makes everything explicit (Klein & Myers, 1999) and can thus act as a trigger for debate. It may well be that proponents of particular methods may disagree with our validity criteria, but at least we provide a target at which to aim.

For a major research question, it may be that all the validity criteria cannot be answered within a single study. There may need to be sequential studies—perhaps some formative studies initially, followed by summative studies later on. Perhaps, different methods will need to be applied to different aspects of the situation, thus invoking different validity questions. Such considerations clearly lead to the possibility of mixed methods work; they also touch on the question of generalizability. In this paper, we distinguished the e-correctness (or validity) of a particular study based on the extent to which it can be generalized to other contexts. However, validity and generalizability are clearly related and the generalization question also raises its own issues of validity that we have not addressed here.

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Appendix A: Theories of Truth

1 Robust or Substantialist Theories of Truth

1.1 Correspondence Theory

The essence of correspondence theory is what is called "alethic[8] realism"—that is, that truth depends on the way the world actually is, so truth has a nature and its nature is objective; it depends on the world itself, not what we believe about it. Correspondence theories involve specifying what may be true ("truth bearer"), the "reality" to which it corresponds ("truth maker"), and the nature of the correspondence relation. There have been a variety of answers to these questions as shown in Table A1.

Table A1. Examples of Correspondence Theories

Theory	Truth bearer	Relation	Truth maker
Russell (1906)	Beliefs	A structural isomorphism between the belief and the facts	Facts: a complex unity of parts and relations
Austin (1950)	Propositions or sentences	Correlation, sometimes conventional, rather than structural isomorphism	Things, features, facts, states of affairs
Field (1974)	Words or sentences	A causal relationship, or state of affair, leads us to make particular statements	The world
Alston (2001)	Propositions: the content of the act of stating or believing	Objective, mind-independent, nonepistemic (i.e., not based on evidence)	Facts about how the world is

These different versions of correspondence theory all share the core concept that there is something, namely the mind-independent world, that makes our beliefs or propositions true whether or not we can discover or justify that truth.

There are many objections to correspondence theory. In brief:

- The consistency problem: that beliefs or statements are different from states of affairs or facts in the world and that the two cannot logically be compared. Beliefs can only be compared to other beliefs.
- The realism problem: that we do not have epistemological access to an independent external reality; we always experience it through our perceptions, cognitions and language, and so can never discover if our beliefs are true.
- The justification problem: that the truth of a proposition is independent of our justification for it, so all our beliefs could be false.
- The scope problem: that propositions could be of so many different kinds (scientific, mathematical, fictional, moral etc.); thus, there can be no one property or causal relation than makes them all true

These arguments have led to the main, substantive, alternatives to correspondence.

1.2 Coherence Theory

Coherence theories differ in terms of both the truth relation and the form of truth maker. In general, coherence theories specify that the relationship is one of internal consistency and coherence with some set of other consistent propositions or beliefs, rather than any reference to an external world. Theoretical holism (Quine & Ullian, 1978) requires that a belief is logically consistent with some system of beliefs but does not specify precisely what that set might be. Joachim (1906) argued that that the set of beliefs must form a comprehensive and significant system of beliefs, and Blanshard (1941) went further saying that such a system should be comprehensive in including all known facts, and where each judgment should entail and be entailed by every other. More recently, Alcoff (2001) has suggested that the system should not consist just of beliefs but also of social practices, traditions and life events, and, moreover, that there can

[8] From the Greek *alethia*, meaning truth

be different sets of beliefs, accounting for different experiences of the world, which may not necessarily be contradictory. Coherence theory has been applied in specific domains such as mathematics.

1.3 Pragmatist and Consensus Theories

These theories judge truth not in terms of correspondence to reality, but in terms of the degree of evidence, agreement or usefulness. For this reason, they are called epistemic theories. They can be traced to the American pragmatist philosophers. For instance, truth for Peirce (1878) was "The opinion which is fated to be ultimately agreed to by all who investigate, is what we mean by the truth." (p. 299) For James (1981), what is important is what practical effect truth would have: "true ideas are those that we can assimilate, validate, corroborate, and verify. False ideas are those that we cannot." (p. 96) Dewey (1938) introduced the idea of "warranted assertibility": "If inquiry begins in doubt, it terminates in the institution of conditions that remove the need for doubt. The latter state of affairs may be designated by the words belief and knowledge. For reasons that I shall state later I prefer the words 'warranted assertibility.'" (p. 7) Thus, from this perspective, there is not an absolute truth, certainly not in correspondence with an external reality. Rather, truth (or perhaps knowledge) is always provisional and fallible, based on the best evidence and information that we have; it moves toward but may never reach, the ideal of certainty.

In more recent times, Putnam (1981) was close to this view in arguing that truth was what we would agree on under ideal epistemic conditions, "ideal warranted assertibility" which would depend on the particular entities being studied and was an ideal in the sense that it could be approached but never realized in practice (he later moved away from this approach). Wright (2009) has proposed the alternative notion of "superassertibility." For Peirce and Putman, getting closer to the truth involves gaining more and more precise information under increasingly ideal conditions. Wright suggests instead that, given some reasonable and practical evidence or information in favor of an idea, we should ask, would it remain warranted no matter how the information was improved or enlarged in the future: "A statement is superassertible, then, if and only if it is or can be warranted and some warrant for it would survive arbitrarily close scrutiny of its pedigree and arbitrarily extensive increments to, or other forms of improvement of, our information" (Wright, 2001, p. 771). It has been suggested that this notion is applicable to domains such as ethics as well.

Habermas, too, essentially had a pragmatist/consensus theory of truth but later changed in a significant way. Originally, with his theory of knowledge constitutive interests (Habermas, 1978), he identified three forms of science—empirical/analytic, hermeneutic (normative) and emancipatory—but all three were underpinned by a discursive theory of truth. Like Putnam, he discussed the circumstances under which ideal agreement could be reached and called the "ideal speech situation" the point at which truth would be generated by "the unforced force of the better argument" (Habermas, 1974, p. 240; 2003, p. 37). So, truth emerges through infinite, unfettered debate.

However, Habermas (2003) now recognizes a substantive difference between the empirical domain and the normative domain. Whereas normative or moral issues can only ever be established through debate and discourse, he now believes that propositional statements about the material world can be proved wrong by events even if they were the result of ideal debate. He states: "I have given up an epistemic conception of truth and have sought to distinguish more clearly between the truth of a proposition and its rational assertibility (even under approximately ideal conditions)" (p. 8).

Habermas now accepts the basic realist view that there is a world independent of human beings, that we all experience the same world, and that this places constraints upon us. However, he still maintains that our access to this world is inevitably conditioned or filtered through our concepts and language: "These objections have prompted me to revise the discursive conception of rational acceptability by relating it to a pragmatically conceived, nonepistemic concept of truth, but without thereby assimilating 'truth' to 'ideal assertibility'" (Habermas, 2003, p. 38).

2 Skeptical and Deflationist Theories

2.1 Deflationist Theories

A number of theories call into question the fundamental premise of robust theories: namely, that truth does, in fact, have a substantial nature that needs to be explained. Ramsey (1927) holds that the concept of truth is essentially redundant. In saying "it is true that snow is white" we are actually adding nothing to the statement that "snow is white." The latter assumes or presumes the idea of truth and there nothing else to be said.

Strawson (1950) maintains that truth is essentially performative; by saying "it is true that snow is white," we are really just recommending or agreeing to the claim, so the truth predicate is not a property but an endorsement.

According to Quine (1992), truth is disquotational: "'Snow is white is true' if and only if snow is white. To ascribe truth to the sentence is to ascribe whiteness to snow; such is the correspondence in this example. Ascription of truth just cancels the quotation marks. Truth is disquotation" (p. 78).

Horwich (1991) argues for what he calls a minimalist theory of truth. This is not a theory of what truth is, but proposes simply that truth is a logical system that has as its axiom every single instance of the general propositional form "The proposition that *p* is true if *p*." An infinite number of such statements is possible; for example, "the proposition that snow is white is true if and only if snow is white."

As can be seen, each of these theories denies in different ways that there should be a substantive explanation of the concept of truth. In general, this is not a conclusion that many philosophers accept, and there are particular criticisms of each of the individual approaches—see Lynch (2001) section 6 for details.

2.2 Skeptical Views

There are also philosophies that deny substantialist forms of truth outlined above in different ways without using deflationary arguments.

As a postmodernist, Foucault is well known for developing the idea that truth is intimately connected to power, such that ideas that are powerful are thereby true. He uses the term "power/knowledge" (Foucault, 1980) to emphasize that the two concepts are inseparable. For Foucault, truth is a system of procedures for producing and ordering knowledge based on systems of power like the scientific community, governments, and the media. There are no objectively true statements but merely statements that pass for true or are accepted as true within a community at a certain time (Allen, 1993, ch. 8).

> *Each society has its regime of truth, its "general politics" of truth: that is, the types of discourse which it accepts and makes function as true; the mechanisms and instances which enable one to distinguish true and false statements, the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true.* (Foucault, 1980, p. 131)

No doubt there is something to this view in the sense that what is taken as true does indeed change across time and different cultures, and what is taken as true is produced through powerful institutions. According to Marx (1965): "The ideas of the ruling class are in every epoch the ruling ideas." But, would we wish to accept the relativism implied by that view? That the sun goes around the earth is as true as the earth goes around the sun, or that unpleasant events are caused by devils or witches? Furthermore, such skepticism would also seem to undermine Foucault's own work, for according to this view, a critique can only be true if it is produced by a system of power; thus, either it is within the system, in which case it is not real critique, or it is outside the system, in which case it is not true.

There is also the solipsistic position, stemming mainly from Descartes (2013), who famously stated that the only thing we can be certain about is our own individual mind. This may be epistemological—i.e., we can only know about our own mind—or it may be ontological, i.e., the world and other minds do not exist. Such extreme skepticism would indeed preclude any form of truth, except that generated by our own internal certainty, and this position is not actually held by any philosophers. Such a viewpoint is also incoherent (Thornton, 2017). In order to even express such a position, it is necessary for there to be some sign-system or language, but, as Wittgenstein (1958) demonstrates with his "private language" arguments, language is irreducibly social. Language consists of many language games that are public not private, and even to question, argue, or doubt something is to enter into a language game and thus assume something external to the individual mind.

3 Pluralist Theories of Truth

3.1 Weak Pluralism

Edwards (2011; 2013) likens truth to the notion of winning a game. We have a general idea of what winning is, but each game is different. To win at chess you need to checkmate, while to win at tennis you need to win the majority of available sets. Although there is some unity of what it means to win or to be a winner that is independent of the particular game involved, determining the winner is different in each game.

In terms of truth, the unity of truth can be captured by a collection of "platitudes," such as "truth is the goal of inquiry" or "truth is a property that is distinct from justification," which describe the nature of truth in general. To see how propositions (Edwards uses propositions as truth bearers) can come to have this truth property, we need to look at specific domains to see what is acceptable to generate truth in that domain. This evaluation has two aspects: First, we must study the subject-matter of the domain to see what type it is—for example, is it genuinely representational or simply discursive or logical. Second, we need to see what kind of property can establish truth in that domain—for example, correspondence between propositions and nonlinguistic entities, coherence between linguistic entities, or a procedure or proof.

We can then form conditionals such as:

- In arithmetical discourse, if *p* coheres with basic axioms then *p* is true.

Or, alternatively:

- In arithmetical discourse, *p* is true if *p* coheres with basic axioms.

Thus, a proposition that is found to be true according to the criteria of its domain is also true generally.

This approach is only a framework and there would be many details to work out:

- Can we determine an exhaustive list of platitudes to define truth in general?
- How do we decide the nature and scope of the various domains?
- Can we determine the content and criteria of a domain adequately and is there an agreed criterion for truth in each domain?
- Can we show that the individual truth criteria do, in fact, imply truth platitudes?

There are other versions of this approach that we will not discuss, such as manifestation functionalism (Lynch, 2009) and the disjunctivist view (Pedersen & Wright, 2013b).

3.2 Correspondence Pluralism

In this section, we discuss two approaches—those of Horgan and Fumerton, respectively.

Horgan (Barnard & Horgan, 2013; 2001) terms his approach "semantically correct assertibility" (note the use of "correct," which links to the next section). Horgan is a realist who accepts that there is a mind-independent and language-independent world, although the world contains humans and their thoughts and activities, which are clearly human-dependent. One of the things we do is make statements or assertions about the way the world is, and these statements may be right or wrong depending on how the world is, which is what we mean by truth. So, for Horgan, truth is always correspondence.

However, Horgan recognizes that in a discourse, there are two different aspects to the way we describe or assert things about the world: (1) Relevant semantics standards that govern the types of things discussed (terms) and their predicates (properties and relations)—called the "positing apparatus." (2) The actual world, which may or may not be as it is described.

In a small number of domains, it is possible that the terms and their predicates may directly correspond to elements of the real world. In such cases, semantic standards are maximally strict and involve direct correspondence. However, in most discourses, such a direct relationship is not possible. The semantic apparatus is relatable to the world and the world may or may not conform to it; thus, truth is possible but in an indirect way. At the extreme, there may be a minimal dependence on the world and truth would be defined almost entirely semantically. An example of this can be seen in mathematics, where there is only the semantic correctness with respect to mathematical axioms.

Most everyday talk and most scientific talk lies between these extremes with assertions about the world being semantically mediated. Consider a statement like: "In 2018 Amazon was the world's biggest Internet company with revenues of $253.9b," which is correct according to Wikipedia.[9] Most of the terms in this statement, such as company, revenue, even Amazon, are complex abstractions that cannot be observed directly in the world in the way that trees or tables can be. Similarly, a statement like "two is the only prime number" is true, even though, ontologically, the world may not contain evenness or primeness as such.

The advantage of Horgan's approach is that, under traditional correspondence theory, it was expected that there were specific truth makers holding a one-to-one correspondence with the elements of truth bearers. Under this view, such a correspondence is no longer necessary: "Claims are true because they really do correspond to the world, even if, (as is typically the case) their positing apparatus does not map directly onto objects, properties and relations that belong to the correct ontology" (Barnard & Horgan, 2013, p. 8).

With this approach, we can accept that much of what is said is indeed true (although discovering which statements are true is different from defining the nature of truth), and that much everyday knowledge is also true. This obviously depends on the validity of the operative semantic standards, but they will likely be aligned with what may be epistemically warranted (i.e., the pragmatic approach to truth), even though the two must not be seen as identical.

[9] https://en.wikipedia.org/wiki/List_of_largest_Internet_companies

Fumerton (2013) also believes that all forms of truth are essentially a correspondence between two elements, but he developed three ideas of particular interest. First, Fumerton maintains that correspondence does not necessarily occur between a belief or proposition and facts about the external world. Correspondence could occur between beliefs or ideas and other sets of ideas as, arguably, Berkeley (1995) held, and would thus be a form of coherence correspondence. Or, there could be a correspondence between beliefs or ideas and perceptions of the world as Hume (1967) held, thus making the facts (truth makers) not mind-independent. Or, there could be a correspondence between pragmatic utterances and the intentions and sincerity of the speaker (Habermas, 1984).[10]

Second, that correspondence truth is not all or nothing, right or wrong. There can be different degrees of truth in the relationships between our beliefs and the world, in the same way that pictures or models may represent with different levels of detail or faithfulness. In any case, our concepts, and even our most precise measurements, always have a degree of vagueness or imprecision about them so that they cannot correspond with the world perfectly. Thus, the degree of truth will depend on the form of representation (and the purpose for which it occurs). Equally, many properties, such as "tall," are intrinsically relative, not absolute. Thus, Tom may be tall in general but not tall relative to the class of basketball players—these two assertions do not contradict each other, they are both true.

Third, that there can be different representations of the same reality without these being necessarily incompatible, i.e., each could be true. This could occur because we investigate different aspects of the same world, e.g., through a microscope or through an X-ray, or with a painting or a photo; or, it could be because we organize our observations differently, perhaps because of different theoretical lenses. What correspondence theory cannot accept is that there are two incompatible pictures that both claim to be true: "that which cannot be stated without contradiction cannot be."

[10] Our suggestion, not Fumerton's

Appendix B: Potential Objections to our Approach

First, our overall assumption is that despite the existence of many different research approaches stemming from different traditions and paradigms (although we do not accept the view that paradigms are incommensurable), it is nevertheless possible to argue that there are some fundamental concepts, such as truth, correctness, and validity, that underlie them all. If scholars are conducting research, then they presumably wish to produce good answers to their research questions, whatever they may be. Our argument is that the answers are likely to be better if attention is paid to qualities such as correctness or validity. Some may disagree with this and argue either that research methods are so different that they have nothing in common, or that concepts such as truth and validity are not important. This is, of course, their right and one of the aims of our paper is to generate just such a debate.

Second, a related aspect of our position is that we accept some form of pluralism, which encourages us to value a wide range of research methods. Watson (1990) suggests that there are four fundamental forms of philosophical pluralism.

- **Perspectival pluralism:** This suggests that a plurality of views comes about because each of us, as individuals, sees and experiences the world differently or, rather, experiences a different world because of our genetics, biology, experiences, and culture. As Watson explains, "We do not experience the same world, but different worlds. Each of us has his own world, his own reality, and there are as many realities as there are perceivers" (p. 358). This form of pluralism underlies the more extreme versions of interpretivism, subjectivism, and constructivism.
- **Pluralism of hypotheses:** This suggests that there is, indeed, one common reality that we all share; however, at any particular time, there are many different and often competing theories and views of that reality. We never ultimately reach or experience that reality, but we may hope to move toward it, because false hypotheses clash with that reality. This form of pluralism can be seen in Peirce (1958), for whom truth is the ultimate endpoint of inquiry, and Popper (1969). Knowledge is always provisional and fallible.
- **Methodological pluralism:** This also suggests that there is one reality, but we cannot know it. Different views are not so much alternatives that compete with each other, as partial and potentially complementary views of the one reality: "The plurality of philosophies does not imply, however, that at most one can be true, but rather that all share in the truth that none possesses wholly" (Watson, 1990, p. 354). This suggests that there is no ultimate incompatibility between competing views; they are each partial views of the same whole. The implication is that different methods or methodologies can access these different views of the world and are thus complementary to each other rather than being in competition, which would suggest a combination of different methods. This is the form of pluralism adopted in this paper.
- **Archic pluralism:** This suggests that different perspectives or philosophies come about from fundamentally different sets of principles or starting points.

In these terms, our pluralism is clearly that of methodological pluralism—we argue that different research methods give us insights into different but complementary aspects of the world, much like an X-ray and a microscope do. Some reveal the hard, material aspects of the world (e.g., an X-ray and a microscope give different views of physical reality); some the social and cultural aspects (e.g., social network analysis or participant observation); and some the personal and psychological aspects (e.g., interviews or cognitive mapping) (Mingers, 2001a).

Third, it could be argued that validity and rigor comprise only one aspect of high-quality research and that concentrating on these aspects alone could come at the expense of, for example, practical relevance or novelty and innovation. We certainly accept this—the best research is rigorous, innovative, and addresses significant issues (Mingers, 2014; Syed, Mingers, & Murray, 2009)—thus, we do not wish to encourage the view that simply ticking the validity box is, by itself, sufficient. But we do argue that, given a significant issue and an innovative idea, the more rigorously the research is carried out, the better the result will be. For this reason, we hope our paper contributes to rigor in research.

Fourth, we argue that it is possible to produce a framework that can actually include a range of heterogeneous approaches. Certainly, in the past many would have argued that the incommensurability thesis made this idea incoherent. Against this view, we argue that not only was the incommensurability thesis flawed in the first place (and not really what Kuhn meant anyway (Hassan & Mingers, 2018), but the concern has generally died away to the extent that mixed-method (and thereby cross-paradigm) work is almost becoming the norm within IS (Mingers, 2001a, 2004a), as well as in the wider domain of social science (Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 1998, 2003).

Fifth, a related but separate concern is that a framework such as ours may actually be used to suppress heterogeneity and innovation (Grover & Lyytinen, 2015). A set of common standards could potentially be applied by journals to

limit both the range and applications of research methods. This is certainly not the intention of our framework. We have tried to be wide-ranging in the methods that we have included; however, it would have been impossible to include everything because methods are always changing and developing. For more discussion of the inclusions and exclusions, see Section 4 above regarding the application of the framework. With regard to disciplinary pressures, we view our framework as having the potential to help with these concerns. First, by including as many approaches as possible within the one framework, based as it is on underlying foundational concepts such as truth and correctness, we are, in a sense, making them all equal. It should no longer be possible to privilege positivism over the other approaches on the grounds of its supposedly greater rigor. Second, putting all approaches in one framework should actually encourage the use of multiple methods, since the framework recognizes that all approaches have validity criteria of their own even though they may be different, thus endowing the pluralist approach with more confidence and credence. We see the framework as an enabler rather than a straitjacket, and as a contribution rather than an endpoint. We hope that it stimulates discussion and debate, and we hope that experts in different approaches further develop the framework to make it more effective.

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